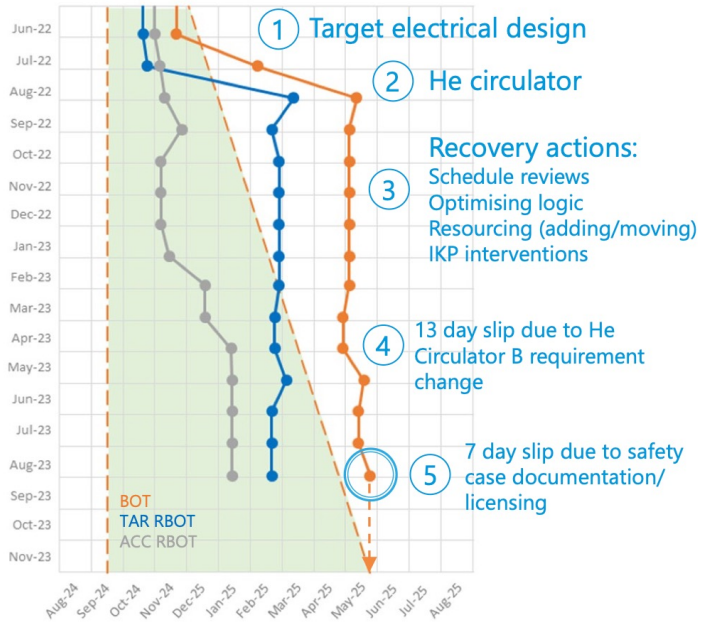
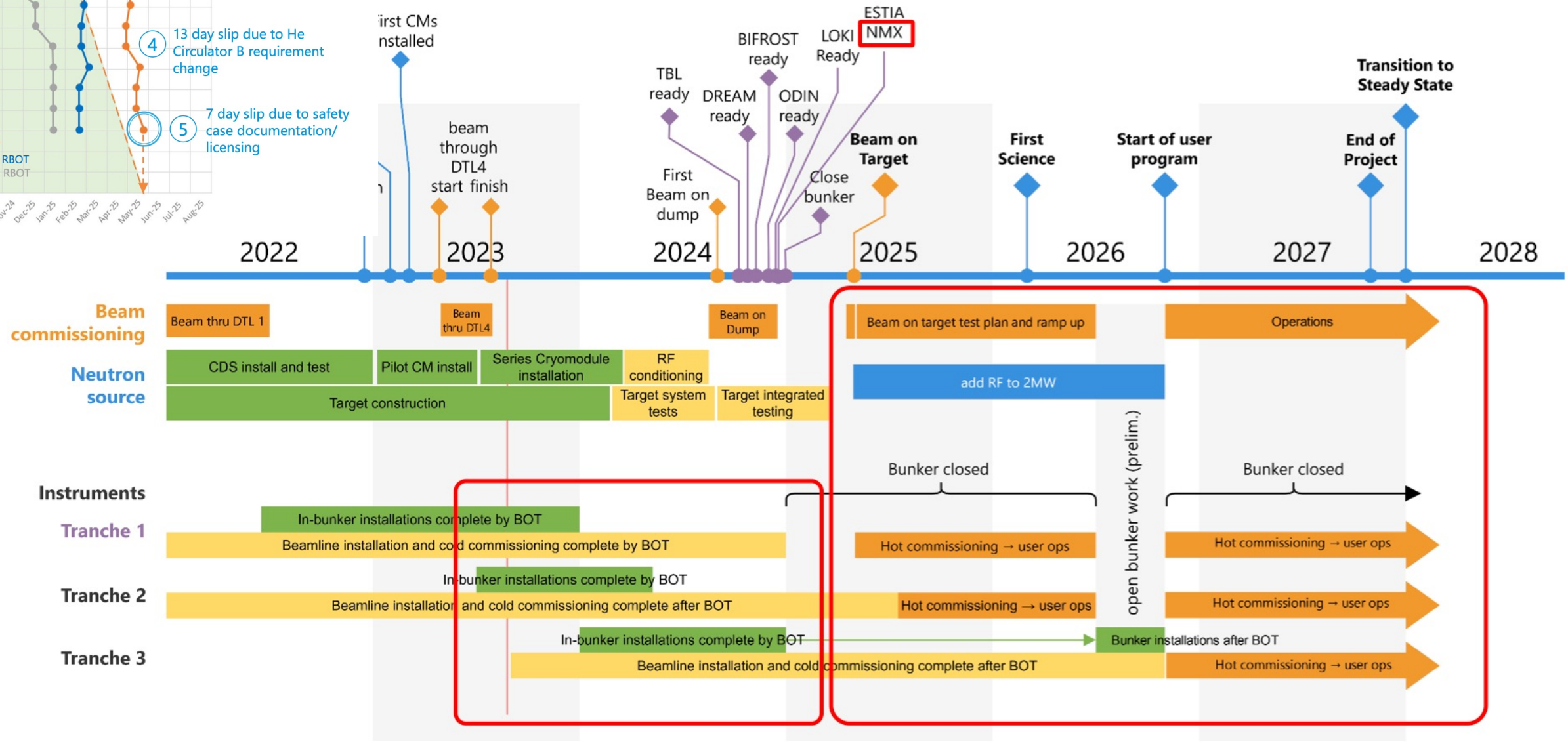
ESS & Science Directorate Update

SANS STAP 2023-10-23

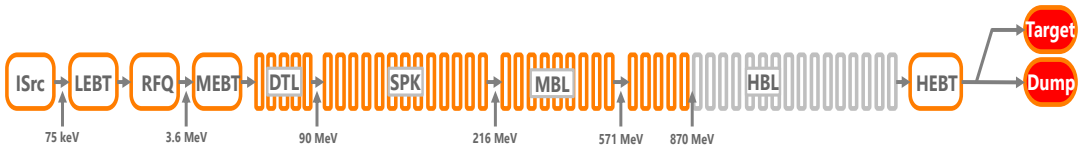
Project Timeline





Recent achievements

Key activities supported by the whole of ESS



NCL up to DTL4 is in place
Beam accelerated to ~74 MeV up to DTL4 FC
Beam commissioning done
Series cryomodule installation under way

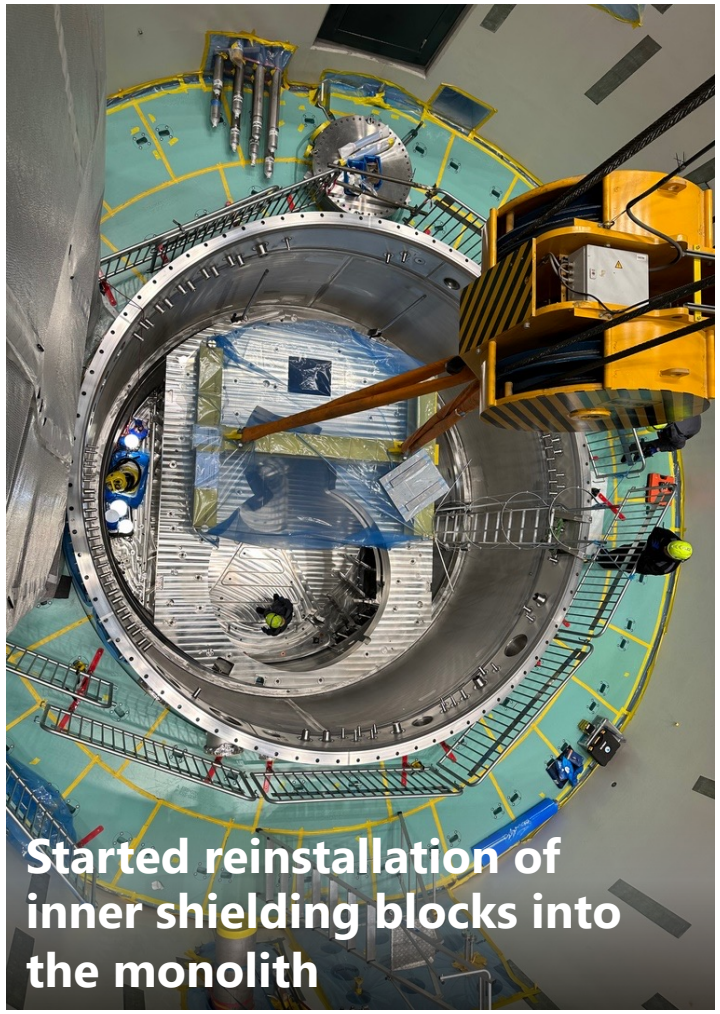
Gallery Spoke and Medium Beta RF Systems under high power testing

CDS Cooldown + CM Series Installation

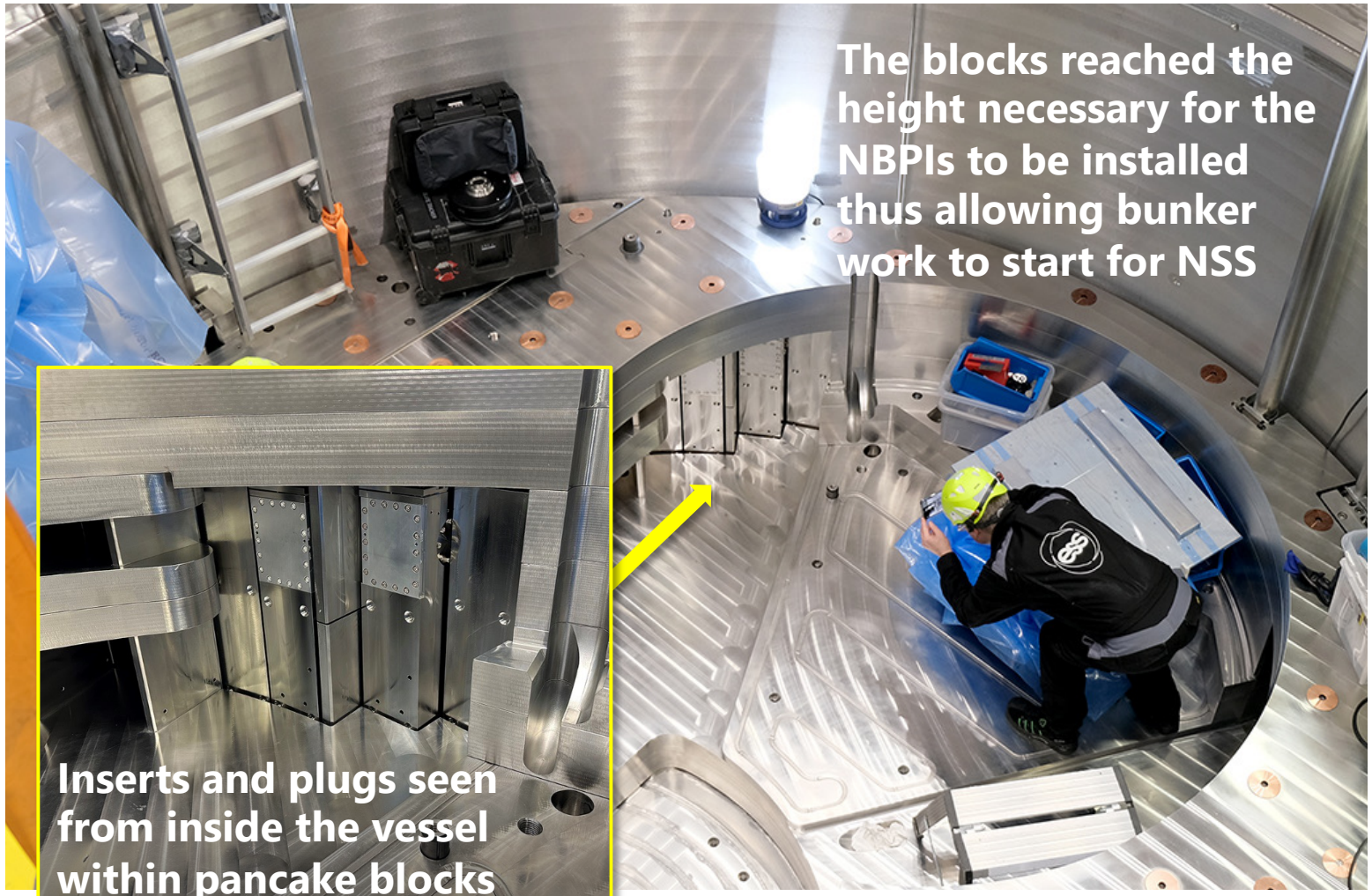
5 SPK + 1 ELL CMs now in the tunnel

Recent achievements

Key activities and progress



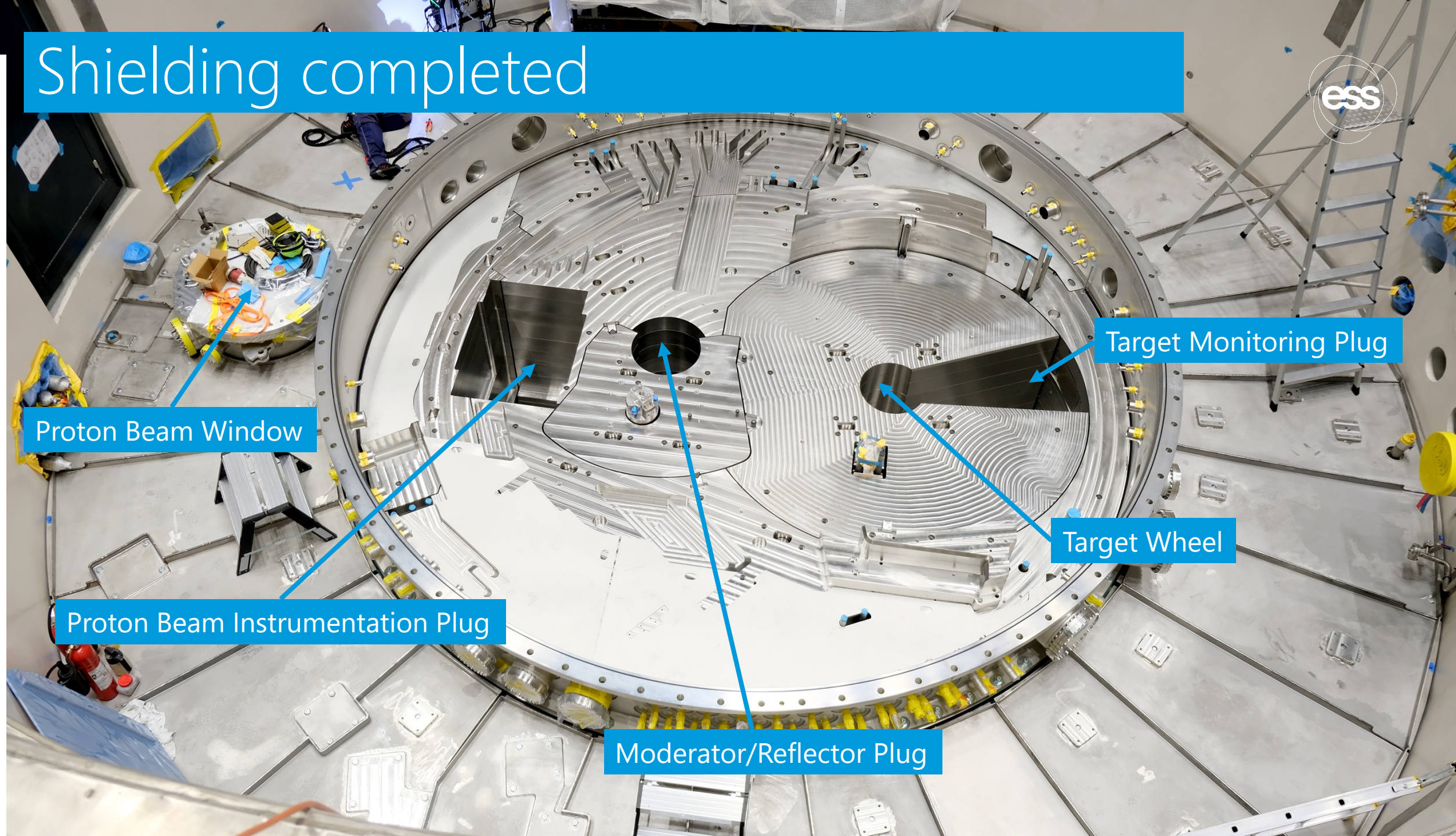
Started reinstallation of inner shielding blocks into the monolith



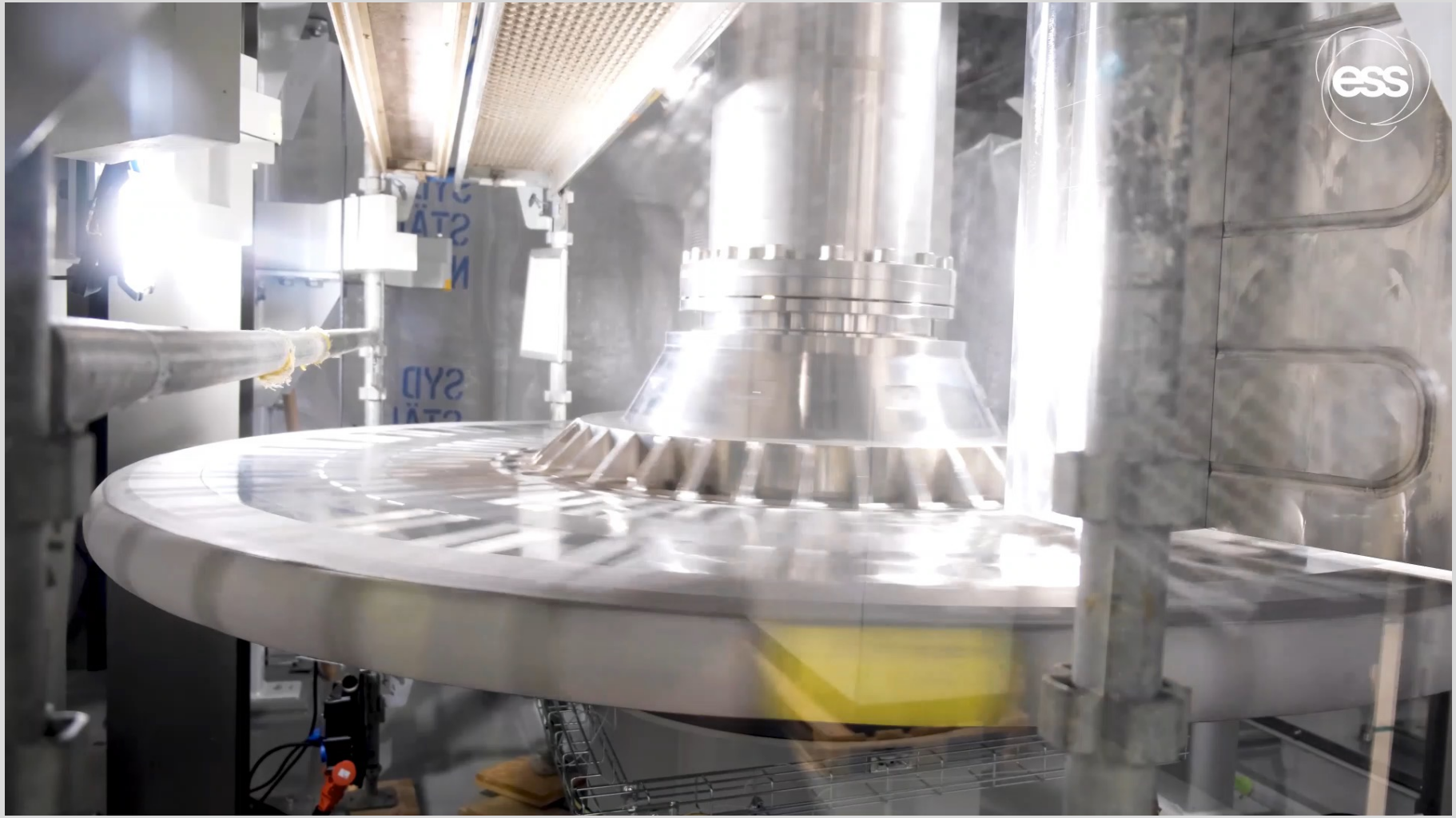
The blocks reached the height necessary for the NBPIs to be installed thus allowing bunker work to start for NSS

Inserts and plugs seen from inside the vessel within pancake blocks

Shielding completed

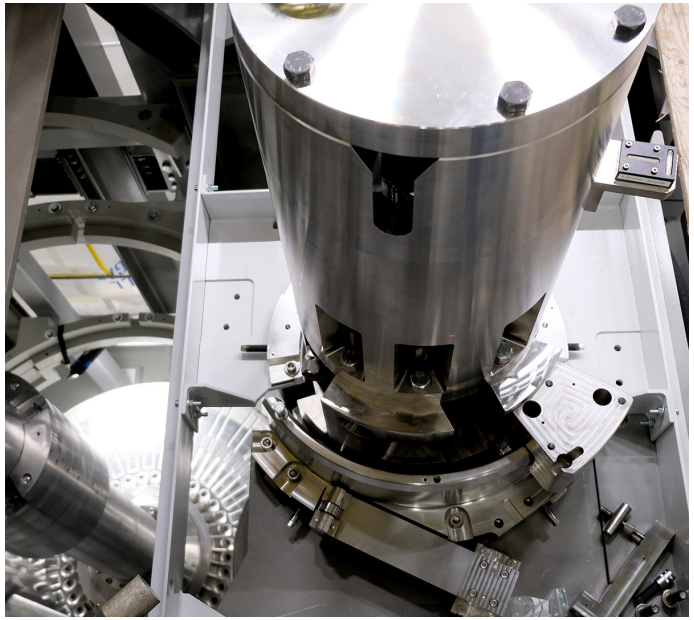


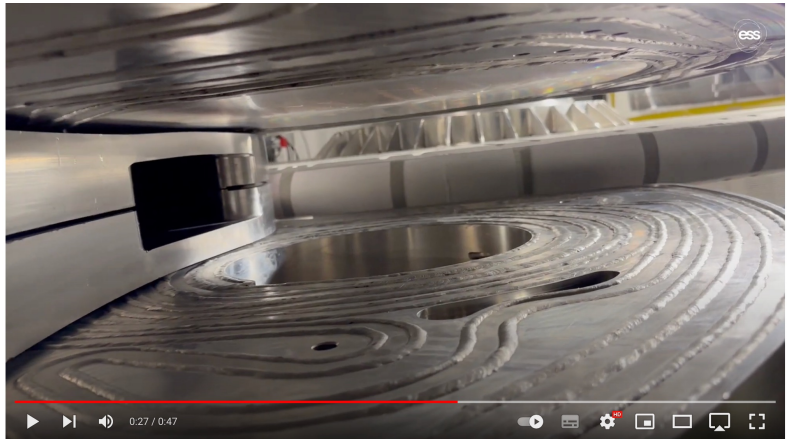
6 weeks test wheel rotation happening now!



Recent achievements

Key activities and progress





Moderator installation in the MUTS and subsequent cleaning of the external and internal surfaces.

Now it is inside a temporary cleanroom next to the MUTS, pending further cleaning/quality improvements.

Installation of inserts and plugs is progressing well, the south sector is complete. Next up is the east sector.

Light Shutter System

All NBPI and windows installed and vacuum test successful!
First light shutter system installed

Some news from the directorate…

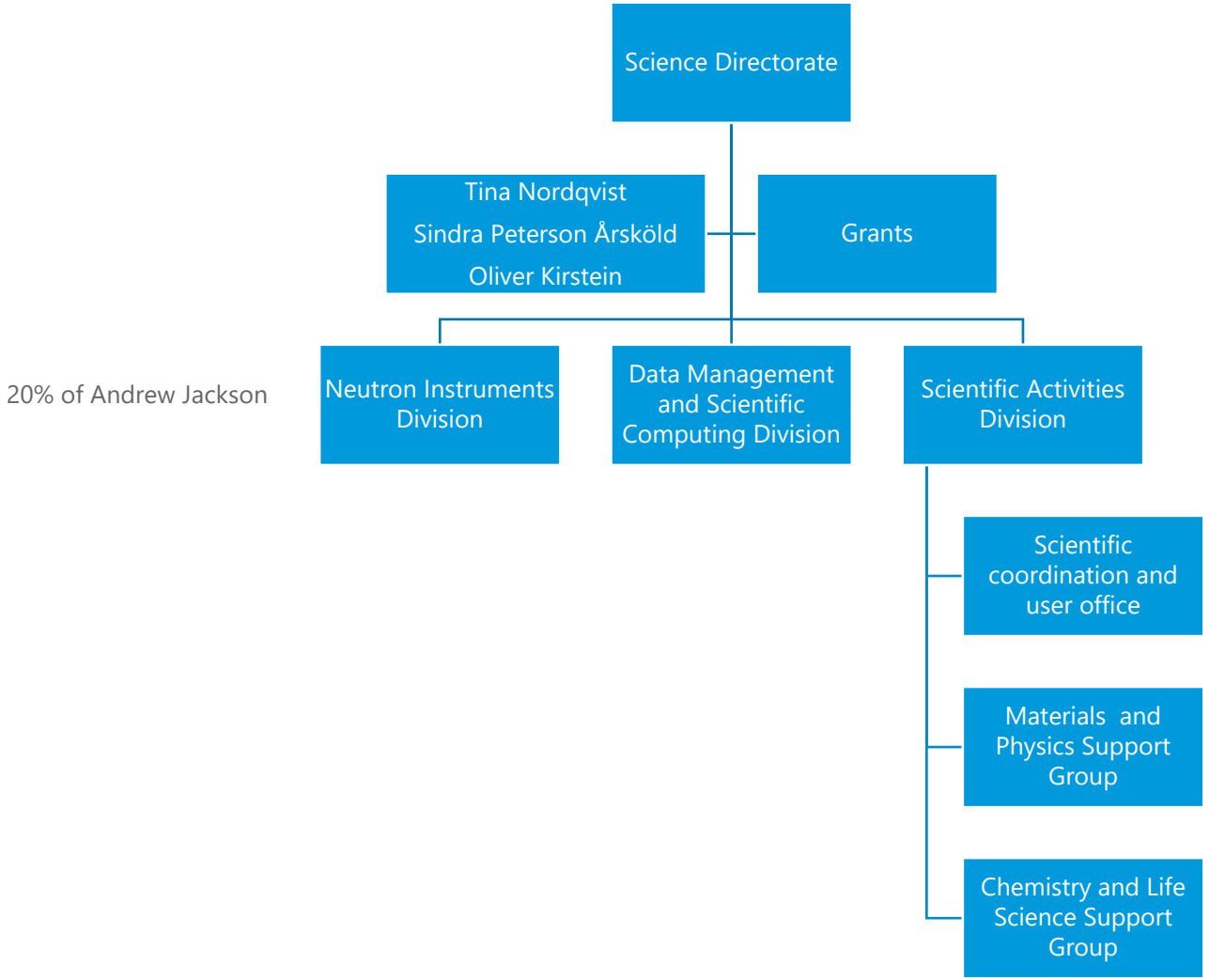
Implementing changes to get ready for delivering neutron science:

- *structure of directorate*
- *benchmarking instruments*
- *plans for user involvement*

2023-10-23

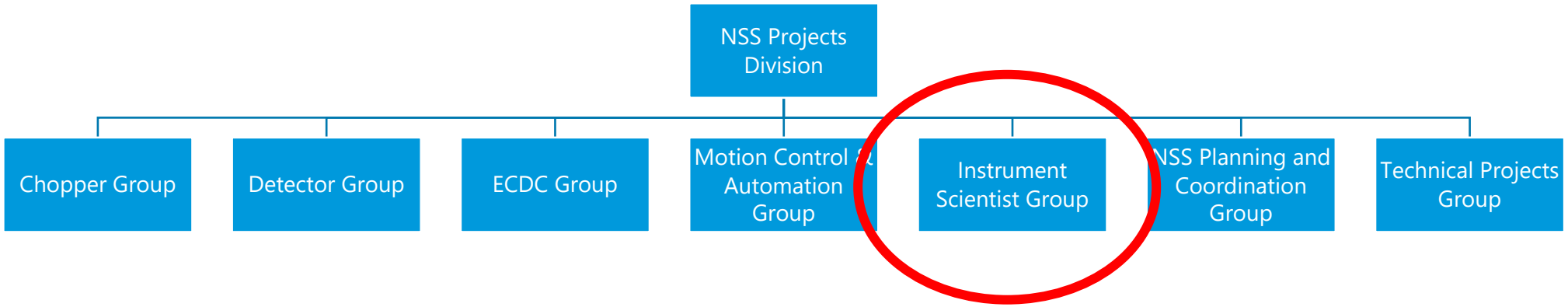
Current organizational chart – Science Directorate

The organisational chart, as it looks now



Current organizational chart – Technical Directorate, NSS Projects Division

The organisational chart, as it looks now



New organisation from January 2024

A stronger science management structure, a more efficient way to carry out scientific activities, a stronger voice for science in the ESS organisation.

It is planned to eliminate the NID division in the Science Directorate and replace it with three instrument divisions where instrument class scientific support will be associated. They will be:

- **Large Scale Structure** Division (personnel affiliated to Loki, Skadi, Estia, Freia, NMX)
- **Spectroscopy** Division (personnel affiliated to BIFROST, C-SPEC, Miracles, T-REX, Vespa)
- **Diffraction and Imaging** Division (personnel affiliated to Dream, Magic, Odin, Heimdal, Beer, TBL)

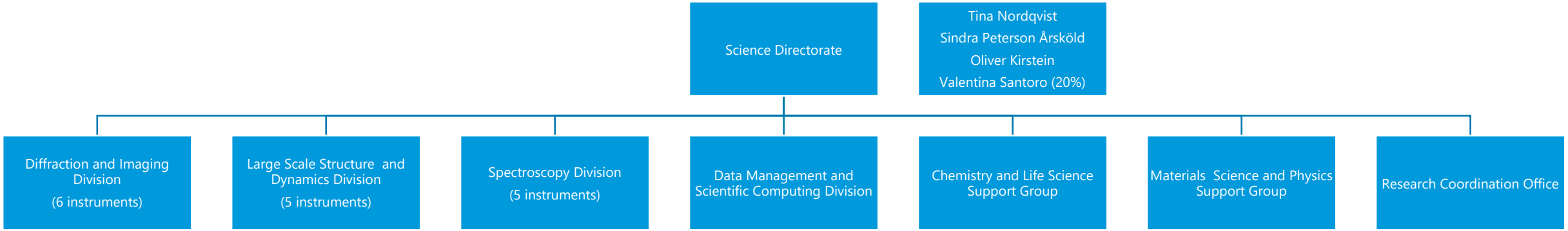
It is also planned create a **Research Coordination Office** group regrouping SCUO, library, communication and grants activities

New organizational chart – Science Directorate

The organisational chart, as it will look from January 2024

Please note that the size of the three instrument divisions will increase largely in 2024 and it is is important that the new divisions' heads participate to the hiring of new scientists.

Head of DMSC – interviews completed
Heads of new divisions and group – selection in progress



Werner Schweika
Mikhail Feygenson
Manuel Morgano
Robin Woracek
Dan Mannix
Premek Beran
Florence Porcher
NN Magic
NN BEER

Andrew Jackson
Judith Houston
Tom Arnold
Sebastian Jaksch
Jos Cooper
Esko Oksanen
Annika Stellhorn
NN NMX

Pascale Deen
Daria Noferini
Rasmus Toft Petersen
NN Vespa
NN Miracles
NN T-Rex

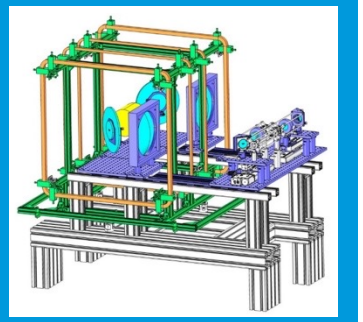
SWAP

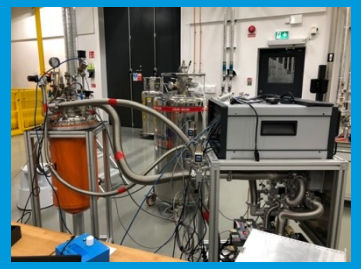
No change

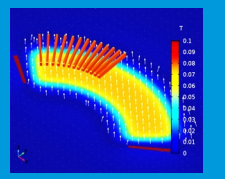
Change of name

Carina Lobley
Fredrik Eriksson
Beate Linneberg

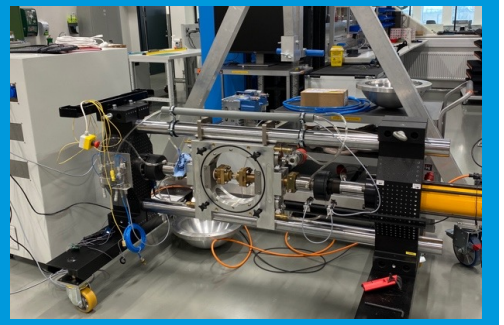
grants
Serkan Ucer
Adrameh Gaye
Anne-Charlotte Joubert







Sample environment & support laboratories



Materials and Physics Support

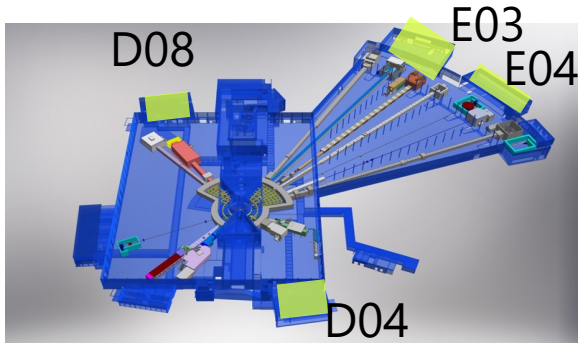
The MPS scope:

- Provide sample environment systems and users support for low and high temperatures, magnetic and electrical fields, high-pressure and mechanical constraints, **polarisation.**
- Provide SES control integration of complex systems and mechanical integration

Chemistry and Life Science Support

The CLS scope:

- Support laboratories (Installation/Spallation Chemistry)
- Sample environment for chemistry and soft matter
- Deuteration service
- Interaction Science



Scientific Coordination and User Office

Ensuring administrative support for science division activities

ESS successfully hosted a booth with the ILL at ECNS 2023

A collaboration between ESS and our neighbouring universities have won the bid to host ICNS 2025 in Copenhagen and Lund

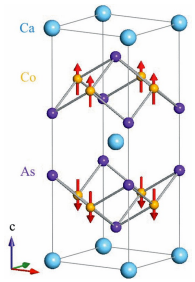
SCUO are working with IT to implement an e-library to provide journal access for ESS scientists

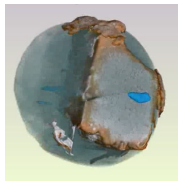
A recently hired librarian will drive this work

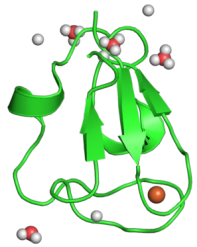
User access policy to be validated at next Council

Data Management and Software Center

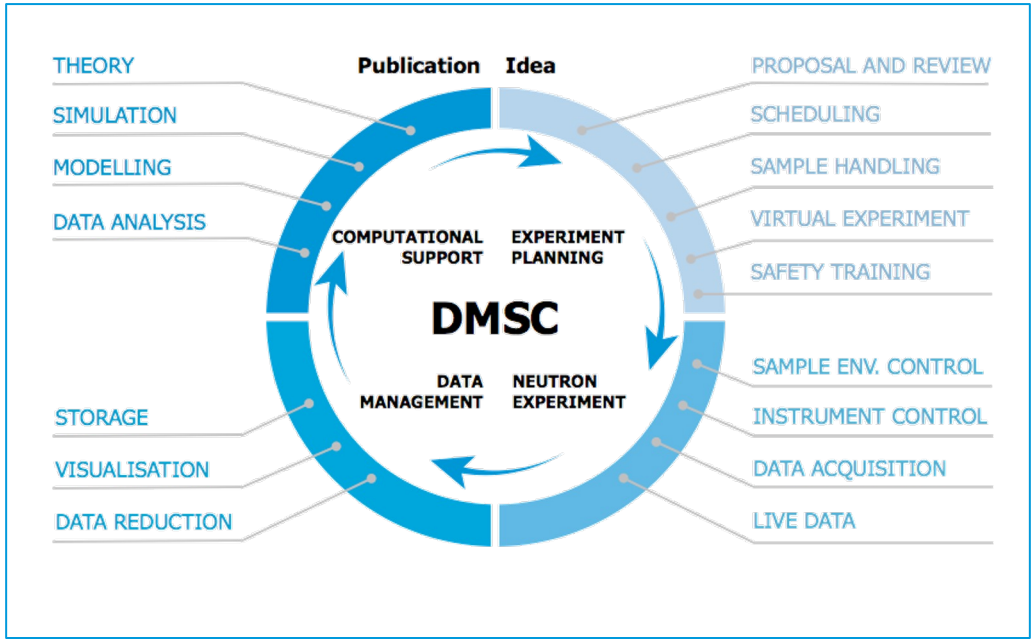
Support user from proposal to publication with scientific computing tools & services

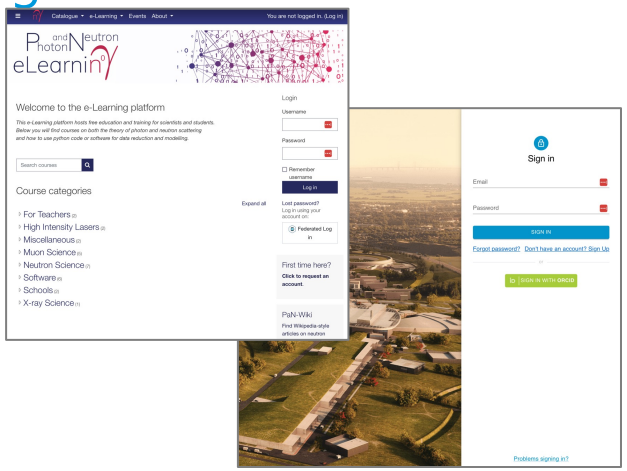


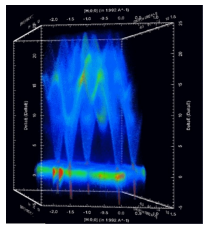


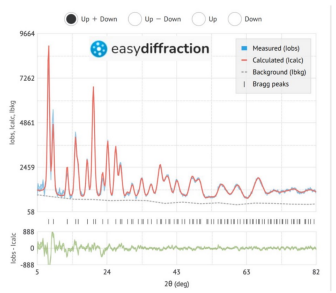


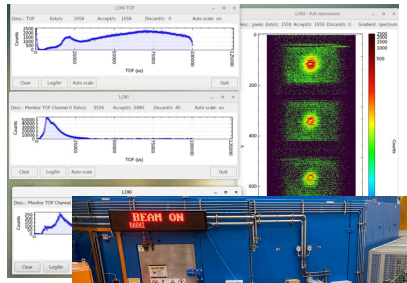
RECENT DECISION TO MOVE IT TO DTU

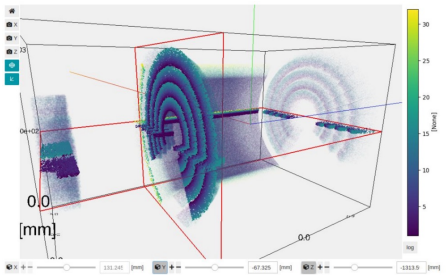


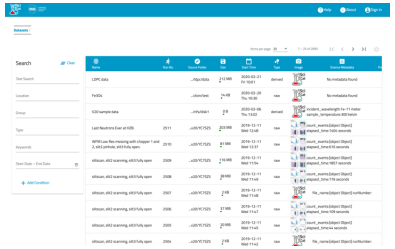


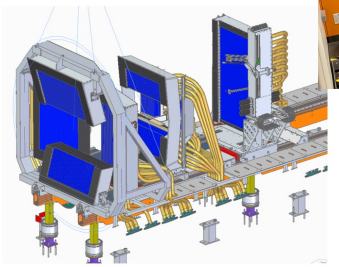












DMSC news

Move to DTU *in March 2024*

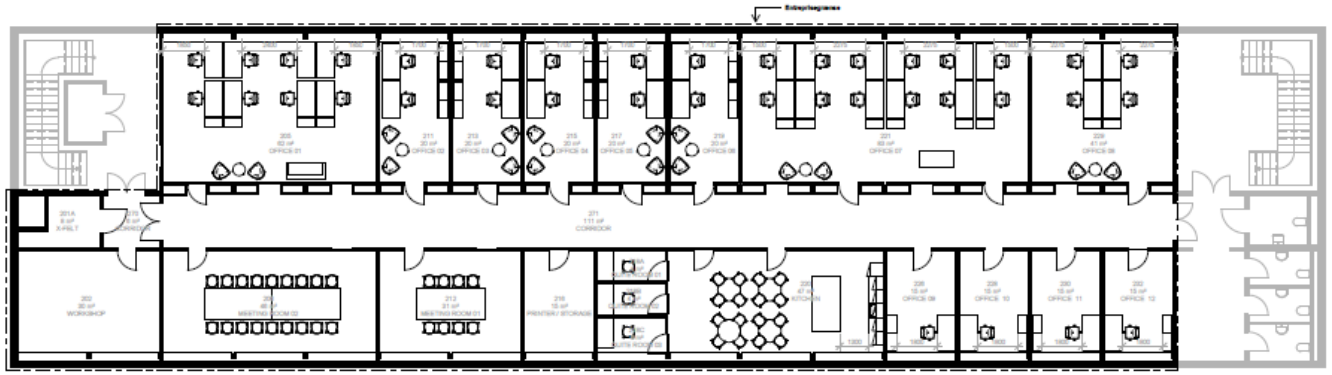
Loss of personnel puts in danger hot commissioning
Location of servers under discussion

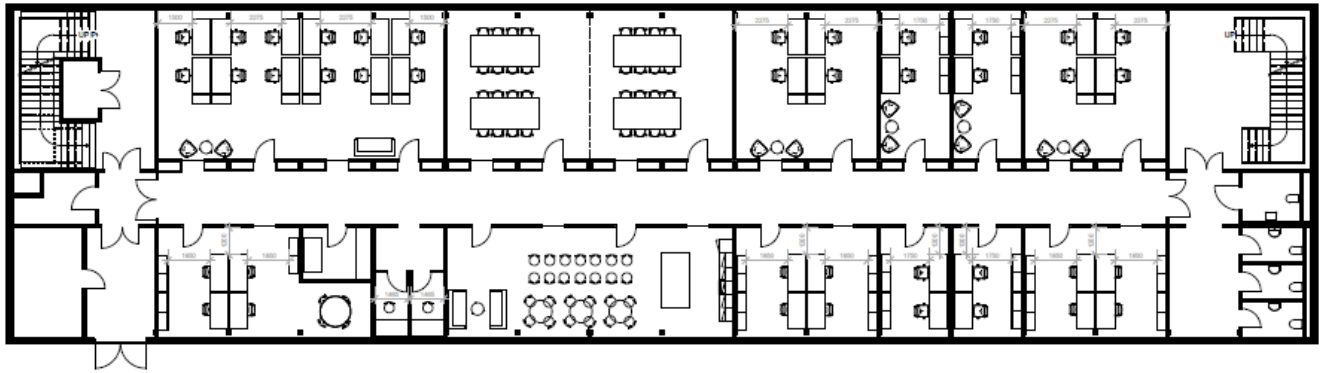
Future office location
Backup system

Current office location
Cph data centre (HPC)

Lund data centre
Support for users, instruments, & Science

Floorplans





Renovation of 2nd floor finished 15th of February 2024

Renovation of 1st floor finished ultimo 2024

Option for opening kitchens to the hallway and internal staircase (TBD 2025)

Staffing and competence

Need to build up competences for user support and driving R&D

1 FTE / instrument – 5 FTEs / instrument div.

Current staff:

- *Céline Durniak (DREAM/MAGIC)*
- *Søren Schmidt (ODIN/BEER)*
- *Gregory Tucker (BIFROST/CSPEC)*
- *Wojciech Potzrebowski (LOKI/SKADI)*
- *Justin Bergmann [PostDoc] (NMX)*

Two open positions: ESTIA/FREIA & NMX

Current (and future) staff have expertise in:

- Neutron scattering
- Materials science
- **Data processing, analysis and modelling**
- Software engineering
- Atomistic simulations
- Instrument simulations
- Data Science (ML/AI)
- User Experience (UX)
- Product Ownership (Requirements)
- Scientific collaborations

ESS instruments & comparisons with world-leading neutron scattering instruments at spallation and reactor facilities.

May 2023

MANUEL MORGANO
TOM ARNOLD
JUDITH HOUSTON
MIKHAIL FEYGENSON
PASCALE DEEN

ROB BEWLEY
JACQUES OLLIVIER
GEORG EHLERS
ROBERT CUBITT
LIONEL PORCAR

- Overview of facility upgrades (ISIS, ILL, SNS) - not considering ISIS-II, SNS-2
- Reality for Instruments at ESS & long pulse
- Overview of Figure of Merit (FOM)
- Overview of FOM for instruments in main instrument classes.

Courtesy Pascale Deen

Comparisons

Essential to capture the flexibility of ESS in a realistic and fair manner
Figure of Merit (FOM) varies per instrument class
i.e. Imaging = Flux on sample
Reflectometry = Peak brightness* divergence (v x h)*λmax/λmin

Main ESS instrument groups represented by a single instrument,
comparisons with spallation and reactor source instruments worldwide

Provide
(a) Overview of the expectation in 2016 , Full Scope, 5 MW and compared to relevant current day instruments
(b) Worldwide facility upgrades. Day 1 scope of ESS instruments, ESS 2 MW. (Not considering moderator)
(c) Worldwide facility upgrades. Full scope of ESS instruments, ESS 5 MW.

Instruments comparisons:
Tomography: ODIN compared to NEXT(ILL), ANTARES(FRM2), ICON(PSI), RADEN(J-Parc), IMAT(ISIS).
SANS: LOKI compared to D22(ILL), SANS2D(ISIS), EQSANS(SNS)
Reflectometry: FREIA, ESTIA compared to D17 (ILL), FIGARO(ILL), BLB (SNS), Inter (ISIS)
Diffraction: DREAM compared to WISH(ISIS), POWGEN(SNS) and D20(ILL)
Spectroscopy: CSPEC compared to IN5(ILL), LET(ISIS), CNCS(SNS) and AMATERAS(J-Parc)

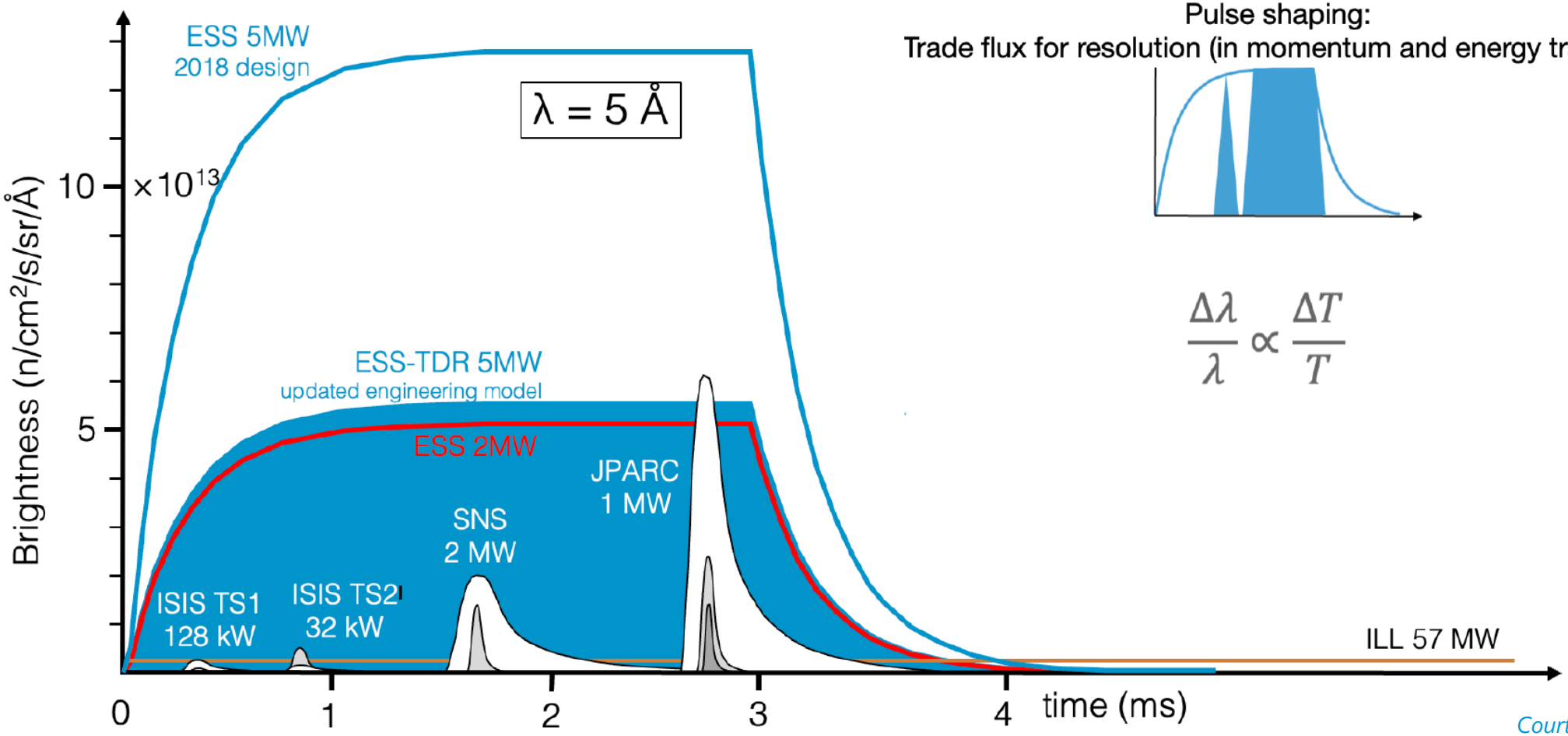
Courtesy Pascale Deen

Capture flexibility of ESS

Time averaged brightness of ESS (2 MW)= Time average brightness of ILL

2 MW Relative ESS/ILL peak brightness = 20

5 MW Relative ESS/ILL peak brightness = 50



Pulse shaping:
Trade flux for resolution (in momentum and energy transfer)

$$\frac{\Delta\lambda}{\lambda} \propto \frac{\Delta T}{T}$$

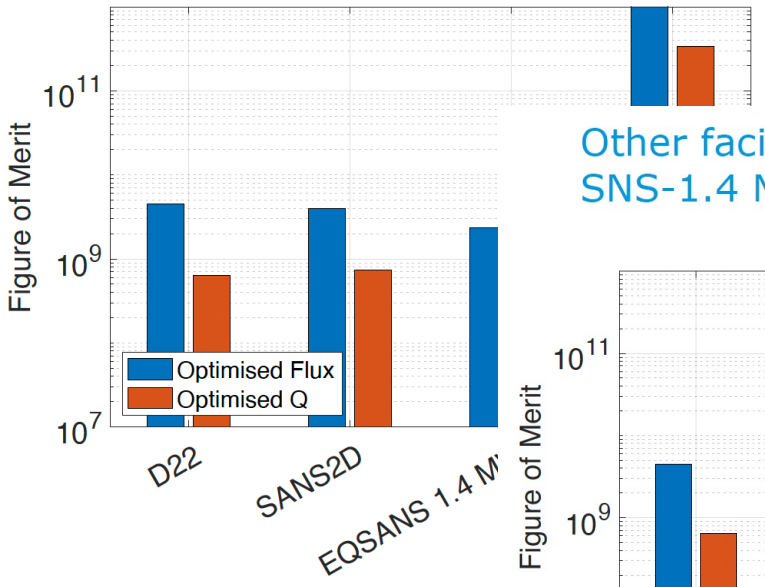
Courtesy Pascale Deen

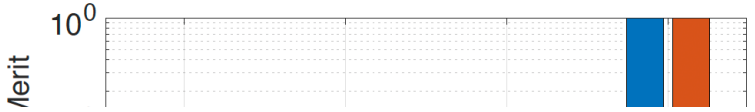
- Tomography
- Reflectometry
- **SANS**
- Diffraction
- TOF Spectroscopy

Loki

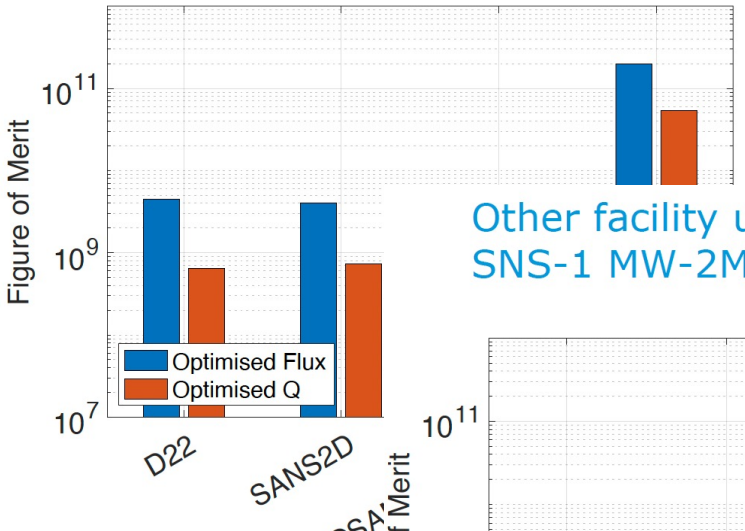
Instrument FOM : Flux (n.cm^{-2}s^{-1}) * detector area coverage (m^2) * Qmax/Qmin

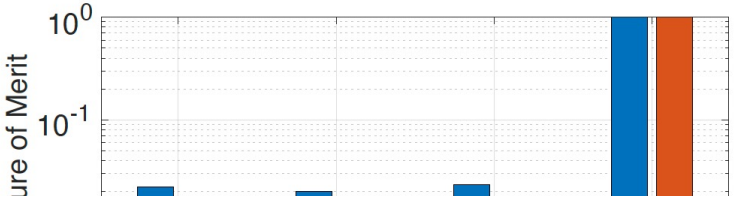
Expectation in 2016: Full scope & 5 MW



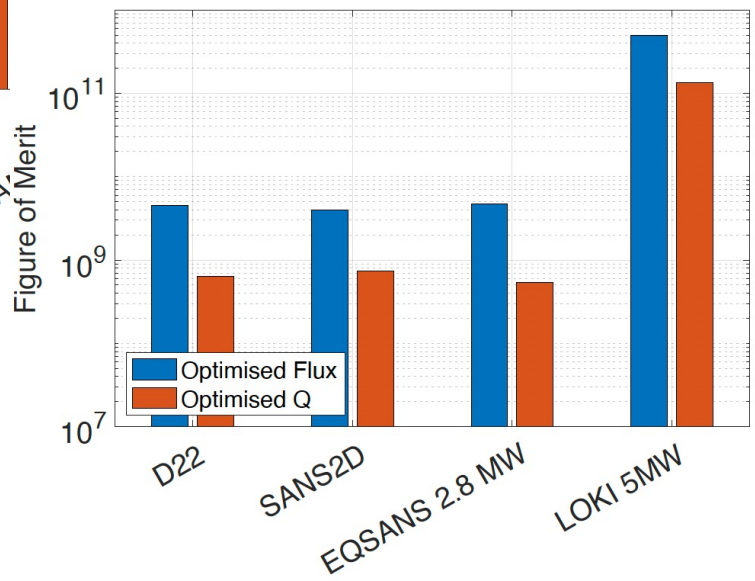


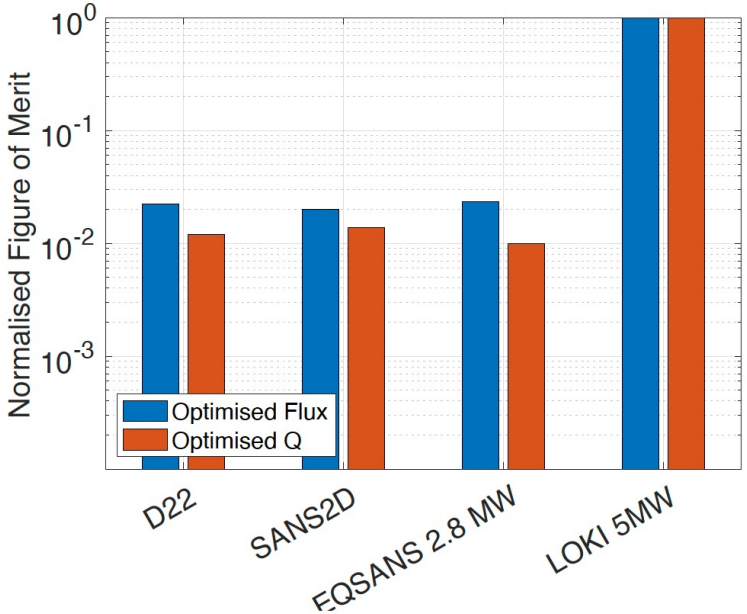
Other facility upgrades:,
SNS-1.4 MW - 2.8MW. ESS-2MW





Other facility upgrades:,
SNS-1 MW-2MW. ESS-5MW





Setting the expectations

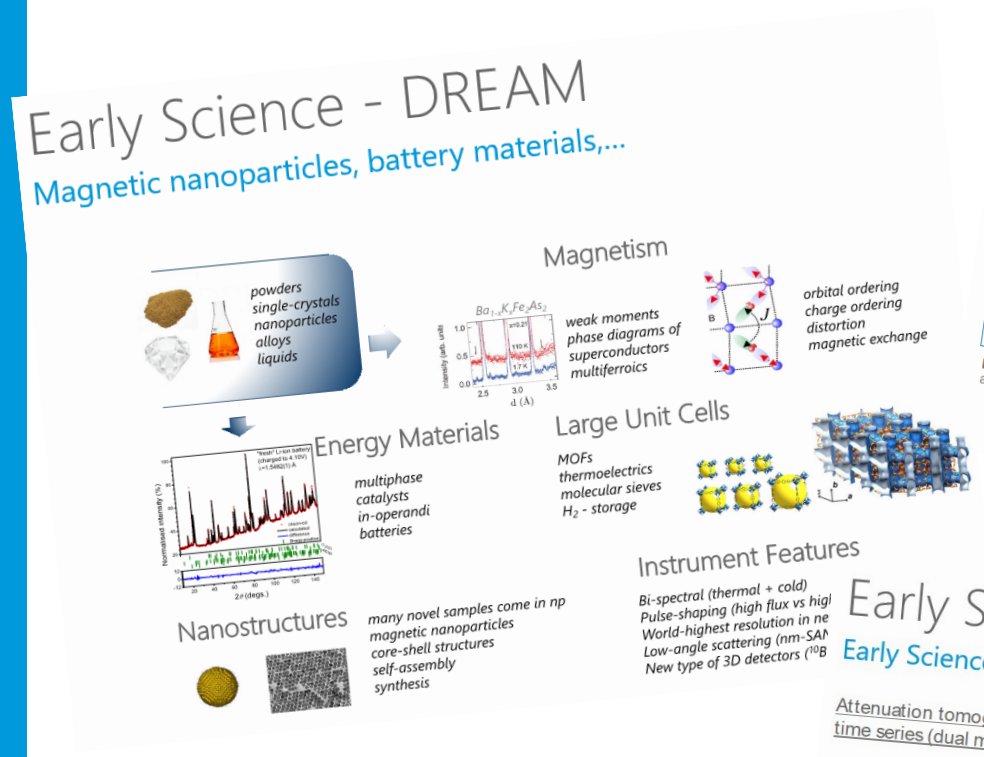
Recent benchmarking with currently upgraded facilities (ILL,SNS, ISIS)
P. Deen et al.

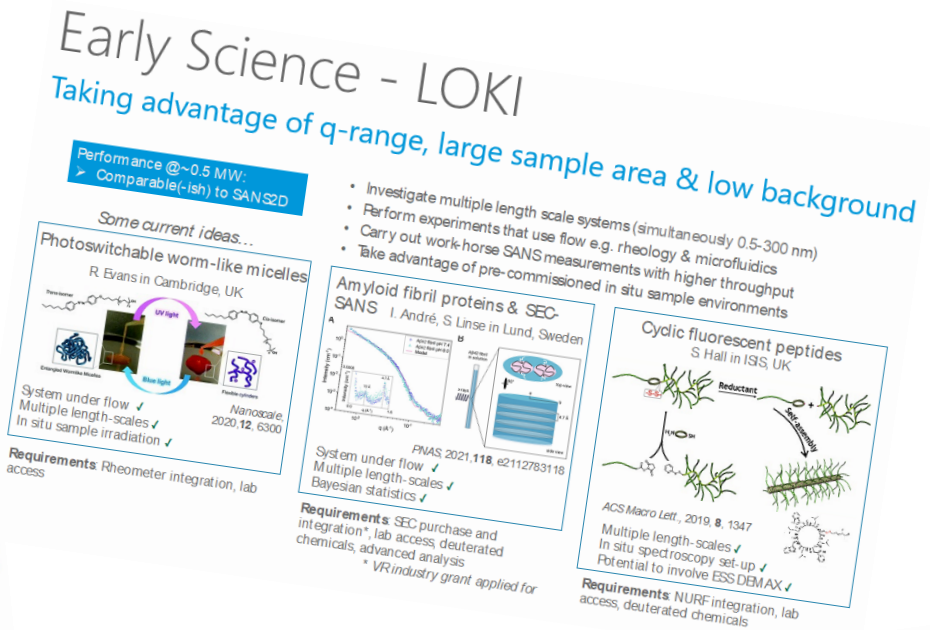
- Instruments will be world leading at full scope and 5 MW.
- Many instrument will be best in class at 2 MW and day-1 scope - but will not provide scope for new scientific endeavours: in-operando behaviour, novel states of matter under extreme environments.
- 5MW and full scope will provide access to new scientific domains.
- Note the complementary strength of the ILL instruments.

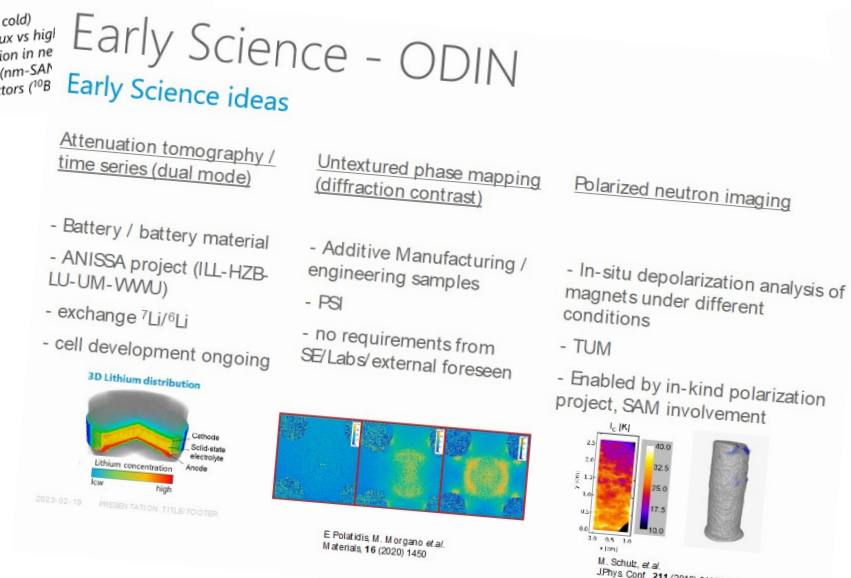
Rescoping the instruments must become a top priority!

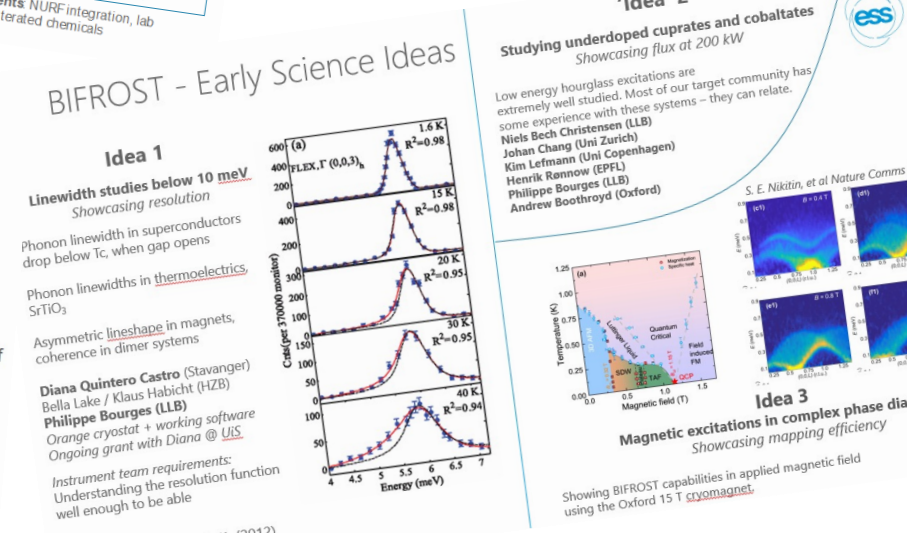
First/Early Science ‘period’

Ideas exist









- Ongoing collaborations
- STAPs
- Early Science workshop
- External funding incentives

ICB satellite meeting 12.09.2023

- Several ideas from partners to contribute to hot commissioning and early science with experienced personnel (for secondments we need to solve the VAT issue and clarify the 45 d/y limit for work in SE)
- MoU draft ready – need to start soon negotiations
- Involvement in future workshops
- Help with scientific supervision of “commissioning scientists”/hosting ESS staff at other neutron facilities
- Much interest in possible ESS post-docs…

Instruments 16-22

Process to be started

GAP analysis to be revisited following update of instrument benchmarking

2018 CAPABILITY GAP ANALYSIS

The identified two most important missing capabilities in the current instrument suite are:

- **Particle Physics**
- **High-Resolution Neutron Spin-Echo**

An analysis of the remaining capability gaps resulted in the following highlight areas:

- High-Pressure Diffraction
- Grazing-Incidence SANS
- Very Fast Spectroscopy
- Wide Bandwidth Spectroscopy
- High Magnetic Fields

where the first four are new instruments, specialised in areas not adequately covered by the current 15 instruments, and the fifth capability need is for sample environment equipment.

Activities are going on in Sweden for NPP and GISANS instrumentation

Provision of a beam port for HIBEAM under consideration
Resuming Fundamental and Particle Physics STAP

Steady State Operation Review

6-8 November 2023

Proposed STAFF in SD:

INSTRUMENTS
FTE/instrument

3 scientists
1 instrument associate
1 post-doc

CHEMISTRY & LIFE SCIENCE support

12 laboratory support
6 deuteration activities
5 sample environment
2 optics support

MATERIAL SCIENCE & PHYSICS support

15 sample environment
3 polarisation activities

RESEARCH COORDINATION OFFICE

9 FTE (*user office, library, industrial liaison, PhD programme, research support*)
3 grant officers

DMSC

60 members of staff as from statutes
1 data scientist/instrument

INSTR. TECHNOLOGY & PROJECTS

70 FTE (*technical support, choppers, detectors, instrument control, projects, ...)*